

CALIBRATION STANDARD REQUIREMENT

FOR A

RF VOLTMETER

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PROCUREMENT PACKAGE

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RF VOLTMETER

1. SCOPE

1.1 Scope. This requirement defines the mechanical, electrical, and electronic characteristics for a RF Voltmeter. This equipment is intended to be used by Navy personnel in shipboard and shorebased laboratories to calibrate amplitudes from RF millivolt signal sources between 10 kHz and 1.2 GHz. For the purposes of this requirement, the RF Voltmeter shall be referred to as the RFVM.

2. APPLICABLE DOCUMENTS

2.1 Controlling Specifications. MIL-T-28800, "Military Specification, Test Equipment for use with Electrical and Electronic Equipment, General Specification for," and all documents referenced therein of the issues in effect on the date of this solicitation shall form a part of this requirement.

3. REQUIREMENTS

3.1 General. The RFVM shall conform to Type II, Class 5, Style E requirements as specified in MIL-T-28800 for Navy shipboard and shorebased use as modified below. the use of material restricted for Navy use shall be governed by MIL-T-28800.

3.1.1 Design and Construction. The RFVM design and construction shall meet the requirements of MIL-T-28800 for Type II equipment.

3.1.2 Power Requirements. The RFVM shall operate from a source of 103.5V to 126.5V at 60 Hz \pm 5% single phase input power as specified in MIL-T-28800.

3.1.2.1 Fuses or Circuit Breakers. Fuses or circuit breakers shall be provided. If circuit breakers are used, both sides of the power source shall be automatically disconnected from the equipment in the event of excessive current. If fuses are used, only the line side of the input power line, as defined by MIL-C-28777, shall be fused. Fuses or circuit breakers shall be readily accessible.

3.1.2.2 Power Connections. The requirements for power source connections shall be in accordance with MIL-T-28800 with a 6 foot (1.8 m) minimum length cord.

3.1.3 Dimensions and Weight. Maximum dimensions shall not exceed 19 inches (48.3 cm) in width, 6 inches (15.2 cm) in height, and 17 inches (43.2 cm) in depth. The weight shall not exceed 20 pounds (9.1 kg).

3.1.4 Lithium Batteries. Per MIL-T-28800, lithium batteries are prohibited without prior authorization. A request for approval for the use of lithium batteries, including those encapsulated in integrated circuits, shall be submitted to the procuring activity

at the time of submission of proposals. Approval shall apply only to the specific model proposed.

3.2 Environmental Requirements. The RFVM shall meet the environmental requirements for a Type II, Class 5, Style E equipment with the deviations specified below.

3.2.1 Temperature and Humidity. The RFVM shall meet the conditions below:

	<u>Temperature ($^{\circ}$C)</u>	<u>Relative Humidity (%)</u>
Operating	18 to 30	75
Non-operating	-40 to 70	Not Controlled

3.2.2 Electromagnetic Compatibility. The electromagnetic compatibility requirements of MIL-T-28800 are limited to the following areas: CE01, CE03, CS01, CS02, CS06, RE01, RE02, (14 kHz to 1 GHz), and RS03.

3.3 Reliability. Type II reliability requirements are as specified in MIL-T-28800.

3.3.1 Calibration Interval. The RFVM shall have an 85% or greater probability of remaining within tolerances of all requirements at the end of a 12 month period.

3.4 Maintainability. The RFVM shall meet the Type II maintainability requirements as specified in MIL-T-28800 except the lowest discrete component shall be defined as a replaceable assembly. Certification time shall not exceed 60 minutes.

3.5 Performance Requirements. The RFVM shall provide the following capabilities as specified below. Unless otherwise indicated, all requirements shall be met following a 30-minute warm-up period.

3.5.1 Measurement Range. The RFVM shall be capable of the following measurements over 8 ranges each:

<u>Function\</u> <u>Measurement Units</u>	<u>Range</u>	<u>Reference</u>
mV	0.2 to 3000	NA
dBmV	-10 to +70	0 dB = 1 mV
dBV	-70 to +10	0 dB = 1 V
dBm	-57 to +23	0 dBm = 1 mW across 50 ohms
dBr	0 to \pm 80	any value from -99.99 dB to +99.99 dB

The RFVM voltage range shall be extended to 300V with the use of a 100:1 voltage divider which shall be furnished as an accessory. The voltage divider shall operate from 50 kHz to 700 MHz.

3.5.2 Display Resolution. The resolution of the RFVM shall be at least 0.01 dB or 0.1 % of voltage range.

3.5.3 Frequency Range. The RFVM shall meet the required performance over a frequency band of 10 kHz to 1.2 GHz, except where specified.

3.5.4 Measurement Uncertainty. The RFVM measurement uncertainty shall not exceed the following over the temperature range of 21 °C to 25 °C.

3.5.4.1 Basic Uncertainty. The basic uncertainty of the RFVM without external probes shall not exceed the following:

<u>Voltage Range</u>	<u>Uncertainty</u>
0.2 mV to 1 mV	± 3.0% rdg ± 3 digits
>1 mV to 3 mV	± 2.0% rdg ± 2 digits
>3 mV to 3000 mV	± 1.0% rdg ± 1 digits

<u>dBm Range</u>	<u>dBmV Range</u>	<u>dBV Range</u>	<u>Uncertainty (dBm, dBmV, dBV)</u>
-57 to -47	-10 to 0	-70 to -60	± 0.53
-47 to -37	0 to +10	-60 to -50	± 0.36
-37 to +23	+10 to +70	-50 to +10	± 0.30

3.5.4.2 Additional Probe Uncertainty. The additional uncertainty added by the 50 ohm terminated BNC probe or high frequency tee adapter described as accessories in paragraph 3.8 shall not exceed the following:

<u>Frequency</u>	<u>mV</u>	<u>dBV, dBmV, dBm</u>
10 kHz to 100 MHz	± 1% rdg	0.09 dB
>100 MHz to 1 GHz	± 3% rdg	0.26 dB
>1 GHz to 1.2 GHz	± 7% rdg	0.63 dB

3.5.4.3 Additional Divider Uncertainty. The additional uncertainty added by the 100:1 probe voltage divider described as an accessory in paragraph 3.8 shall not exceed $\pm(1 + f_{\text{MHz}} / 200)\%$ over the frequency range of 50 kHz to 700 MHz.

3.5.5 50 Ohm Terminated BNC Probe and Tee VSWR. The maximum VSWR of the RFVM 50 ohm terminated probe adapter and the high frequency tee adapter described in paragraph 3.8 shall not exceed the following:

Frequency Range50 ohm BNC Input

10 kHz to 300 MHz	≥ 1.05
>300 MHz to 1 GHz	≥ 1.10
>1 GHz to 1.2 GHz	≥ 1.15

3.5.6 Waveform Response. Voltage indication shall be True RMS at 30 mV and below.

3.5.7 Display. The display shall be at least a 3 1/2 digit display and shall read either in millivolts or in dB relative to 1 mV, 1.0 V or to 1 mW. An analog meter shall indicate voltage levels for peaking or nulling purposes.

3.5.8 Autoranging. The RFVM shall provide autoranging and a hold-range function.

3.5.9 DC Recorder Output. A rear panel DC output shall supply an analog voltage that is linear with voltage over each decade range in the mV mode. For the dB modes, the output sensitivity shall be 1.0 volts per 10 dB change of input to the RFVM over the 80 dB range. For dBm mode, 8 volts output shall indicate 0.0 dBm input to the RFVM.

3.5.10 Auto Zero. The RFVM shall provide a front panel switch to activate an automatic zero mode. This function shall zero offsets of each range and automatically correct all subsequent readings.

3.6 Operating Requirements. The RFVM shall provide the following operating capabilities.

3.6.1 Front Panel Control Requirements. All modes and functions shall be operable using front panel controls. The locations and labeling of indicators, controls, and switches shall provide for maximum clarity and easily understood operation without reference to tables, charts, or flow diagrams.

3.6.2 Programmability. All modes and functions shall be fully remotely programmable via the IEEE-488.1 instrumentation bus. When operating the RFVM via remote programming, all front panel controls shall be disabled, except for the on/off switch and the Remote/Local switch.

3.6.3 Error Correction. During calibration, the RFVM shall provide the capability to accept and store corrections for all measurement deviations from nominal conditions. This correction capability shall be operational from the front panel control and over the IEEE-488 bus. The RFVM shall be capable of changing any calibration factor or other correction data stored in memory of the RFVM without removal of any memory circuits or devices. When the RFVM is operated within its calibration period, it shall meet

all the specified performance requirements without requiring the additional entry of any calibration factor or other correction data by the operator, including correction data entered by an instrument controller.

3.6.4 Self-Test. The RFVM shall be capable of determining if the instrument is operationally ready when powered up, and be capable of diagnosing and isolating faulty field replaceable modules. When the RFVM is powered up, an autosequenced internal operation test shall be performed.

3.6.5 IEEE Interface. The RFVM shall have an IEEE-488.1 interface connector with the following capabilities: SH1, AH1, T6, L4, SR1, RL1, DT1. Serial poll capability shall be provided.

3.7 Manual. At least two copies of an operation and maintenance manual shall be provided. The manual shall meet the requirements of MIL-M-7298.

3.7.1 Calibration Procedure. The manual shall provide a RFVM calibration procedure in accordance with MIL-M-38793.

3.8 Accessories. The following accessories shall be provided with each RFVM.

3.8.1 One power cable in accordance with MIL-T-28800 with minimum length of 6 feet (1.8 m).

3.8.2 One three foot (1 m) minimum length probe/cable, to be used in conjunction with the following probe tips and adapters.

3.8.3 One 50 ohm terminated BNC female adapter to be used in conjunction with the probe/cable and following 100:1 voltage divider.

3.8.4 One high frequency probe tee adapter with N type female connectors to adapt the probe/cable to a 50 ohm system.

3.8.5 One probe tip with ground clip to be used in conjunction with the probe/cable and the following 100:1 voltage divider with a frequency range of at least 100 Mhz.

3.8.6 One unterminated BNC female adapter to be used in conjunction with the probe/cable and following 100:1 voltage divider.

3.8.7 One 100:1 voltage divider to be used in conjunction with the probe/cable and other probe tips and probe adapters.